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EXAMINER

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/534,125
Filing Date: November 18, 2005
Appellant(s): MAYER ET AL.

MAILED
JUL 27 2007
Group 3700

Ronald E. Greigg
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed on March 22, 2007 appealing from the Office action mailed on August 24, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,921,076	KRUTZSCH ET AL.	7-1999
2002/0038542	AKAMA ET AL.	4-2002
6,109,024	KINUGASA ET AL.	8-2000

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 11-20 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Krutzsch et al. (U.S. Patent 5,921,076) in view of Akama et al. (U.S. Patent Application 2002/0038542).

Re claims 11 and 30, as depicted in Figure 1, Krutzsch et al. disclose a method and an apparatus for post-treatment of the exhaust gas of an internal combustion engine (1), in which nitric oxides contained in the exhaust gas are selectively catalytically reduced, the method comprising:

- delivering a first auxiliary agent (HC) from a supply (5) thereof to the exhaust gas;
- subjecting an hydrogen producing fluid (water, methanol, HC) at least intermittently to a chemical conversion (in hydrogen generator (6)) into a second auxiliary agent (hydrogen) (see lines 56-60 of column 2);

Art Unit: 3748

- storing the second auxiliary agent in an intermediate reservoir (6) (lines 56-60 of column 2); and

- at least intermittently, delivering the second auxiliary agent to the exhaust gas parallel to or in alternation with the first auxiliary agent (see lines 11-30 of column 4 and Figures 3-4).

Krutzsch et al., however, fail to disclose that the HC generator (5) is incorporated with the hydrogen generator (6).

As shown in Figure 1, Akama et al. teach that it is conventional in the art to incorporate a hydrogen generator (10) with a fuel tank (7) so that a fuel from the fuel tank is reformed with a carrier gas (exhaust gas) in the hydrogen generator to produce a hydrogen-containing gas for injection into an exhaust gas stream to remove NO_x at a NO_x reducing catalyst (6). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Akama et al. in the method and apparatus of Krutzsch et al., since the use thereof would have been routinely utilized by those with ordinary skill in the art to reduce complexity in an exhaust gas system.

Re claims 12-13, in the modified method of Krutzsch et al., in a so-called normal operating mode of the engine, a delivery of the first auxiliary agent exclusively is effected, and wherein at selected time intervals outside the normal operating mode, in particular during a cold-starting phase of the engine, a delivery of the second auxiliary agent exclusively is effected (lines 12-17 of column 4), wherein the chemical conversion is effected during the normal operating mode (generator (6) is also used for storing hydrogen).

Re claims 14-16, in the modified method of Krutzsch et al., it is obvious that the chemical conversion is performed only until such time as the intermediate reservoir is full.

Re claims 17-20, in the modified method of Kruttsch et al., it is also obvious that in order to save space and cost, the volume of the intermediate reservoir is dimensioned such that a quantity of second auxiliary agent that meets the demand for the second auxiliary agent during a cold-starting phase of the engine is stored.

2. Claims 21, 24; 22, 25; and 23, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kruttsch et al. in view of Akama et al. as applied to claims 11; 12; and 13, respectively, above, and further in view of design choice.

In the modified method of Kruttsch et al., the first auxiliary agent is HC and the second auxiliary agent is ammonia. Thus, they fail to disclose that the first auxiliary agent is a substance that releases ammonia at sufficiently high temperatures and the second auxiliary agent is ammonia.

Reducing agents for use in internal combustion engines can take the form of many different compounds such as hydrogen, diesel fuel, urea, etc. One having ordinary skill in the art would have selected the specific compound based on available resources. For example, the reducing fluid for a NOx catalyst with a diesel engine would normally be diesel fuel because diesel fuel would be readily accessible. In gasoline engines, one having ordinary skill in the art would have selected any of the known reducing agents based on necessity, since gasoline engines normally would not have diesel fuel on board. One of the other fluids mentioned above such as urea would have to be selected for a gasoline engine. Therefore, with regard to applicants claim directed to a specified auxiliary agent, the specification of such would have been an obvious matter of design choice well within the level of ordinary skill in the art depending on design variables, such as a type of the engine (i.e., for a diesel engine, a system

Art Unit: 3748

that has HC and hydrogen is used. On the other hand, for a gasoline engine, a system that has urea and ammonia is used). Moreover, there is nothing in the record which establishes that the specification of such presents a novel or unexpected result (See *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975)).

3. Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Krutzsch et al. in view of Akama et al. as applied to claims 11 and 12, respectively, above, and further in view of design choice and Kinugasa et al. (U.S. Patent 6,109,024).

The modified method of Krutzsch et al. discloses the invention as cited above, however, fails to disclose that the first auxiliary agent is a substance that releases ammonia and the second auxiliary agent is ammonia; and that a zeolite body or a salt that forms an ammonia complex is used as the intermediate reservoir.

Reducing agents for use in internal combustion engines can take the form of many different compounds such as hydrogen, diesel fuel, urea, etc. One having ordinary skill in the art would have selected the specific compound based on available resources. For example, the reducing fluid for a NOx catalyst with a diesel engine would normally be diesel fuel because diesel fuel would be readily accessible. In gasoline engines, one having ordinary skill in the art would have selected any of the known reducing agents based on necessity, since gasoline engines normally would not have diesel fuel on board. One of the other fluids mentioned above such as urea would have to be selected for a gasoline engine. Therefore, with regard to applicants' claim directed to a specified auxiliary agent, the specification of such would have been an obvious matter of design choice well within the level of ordinary skill in the art depending on design variables, such as a type of the engine (i.e., for a diesel engine, a system

Art Unit: 3748

that has HC and hydrogen is used. On the other hand, for a gasoline engine, a system that has urea and ammonia is used). Moreover, there is nothing in the record which establishes that the specification of such presents a novel or unexpected result (See *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975)).

As shown in Figure 1, Kinugasa et al. disclose an exhaust gas after-treatment device comprising an ammonia adsorbing-denitrating catalyst (9). As indicated on lines 31-39 of column 10, they teach that it is conventional in the art to utilize a zeolite body as a component in the ammonia adsorbing-denitrating catalyst (9) to adsorb ammonia. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Kinugasa et al. in the modified method of Krutzsch et al., since the use thereof would have been routinely utilized by those with ordinary skill in the art to store ammonia for a future use.

(10) Response to Argument

BRIEF BACKGROUND OF KRUTZSCH ET AL.:

As shown in Figure 1, Krutzsch et al. disclose a process and an apparatus for reducing NO_x in an exhaust gas stream of an internal combustion engine (1), the NO_x being selectively reduced by a catalyst (3) by means of two reducing agents (hydrocarbons (HC) and hydrogen) added in a metered manner to the exhaust gas stream as a function of an operating temperature of the catalyst. As indicated on lines 11-49 of column 4, Krutzsch et al. supply only hydrogen to the exhaust gas upstream of the catalyst when the engine is in a first operating range with a low catalyst temperature range. When the engine is in a second operating range with the catalyst in a

Art Unit: 3748

moderate temperature range, they supply to the exhaust gas stream with both hydrogen and HC. And when the engine is in a third operating range with the catalyst in a high temperature range, they supply only HC to the exhaust stream. This alternate or parallel delivery of the two reducing agents is done by Krutzsch et al. to take advantage of the different temperature ranges for optimum NO_x conversion by the reducing agents. As shown in Figure 4, the optimum NO_x conversion for the catalyst used in Krutzsch et al. with hydrogen as the reducing agent is between 100°C and 150°C; and that with HC as the reducing agent is between 250°C and 300°C. As indicated on lines 56-60 of column 2, Krutzsch et al. also disclose that a number of arrangements can be used for generating or storing hydrogen. This includes the generating of cracked gas (i.e., hydrogen) from a hydrogen-containing fluid.

BRIEF BACKGROUND OF AKAMA ET AL.:

As depicted in Figure 1, Akama et al. disclose or teach a hydrogen-containing gas producing system and an exhaust gas purifying system using hydrogen gas, comprising a reforming catalyst (10a) to reform or crack a HC fuel into a hydrogen-containing gas. The HC fuel is supplied directly from a HC fuel tank (7) that is also used to supply fuel to an internal combustion engine (1) (see paragraph 0030). The hydrogen-containing gas is then stored in a storage reservoir (11) so that the gas is always available for use to reduce NO_x at a reducing catalyst (6) for a variation of engine operating conditions or changes in air-fuel ratio of exhaust gas flowing into the catalyst (see paragraph 0045).

ISSUE 1: With regard to the 35 U.S.C. 103 rejection of independent claims 11 and 30, Krutzsch et al. and Akama et al. fail to disclose or suggest all of the claimed features.

In response to appellant's argument that Krutzsch et al. and Akama et al. fail to disclose the steps of a) subjecting a portion of the first auxiliary agent to a chemical conversion into a second auxiliary agent, and b) storing the second auxiliary agent in an intermediate reservoir (page 11 of Appellant's Appeal Brief), the examiner respectfully disagrees.

Regarding step a), the text on lines 56-60 of column 2 in Krutzsch et al. reads as follows:

"Any arrangement for generating or storing hydrogen can be used as the H₂ generator (6). Particularly for a use in motor vehicles, the electrolysis of water, the generating of cracked gas or the reforming of methanol can be used for this purpose." (emphasis added by examiner)

Based on the above disclosure, Krutzsch et al. disclose or teach that a chemical conversion process for the generating of cracked gas is used to generate a hydrogen gas, wherein the "cracked gas" referred to by Krutzsch et al. is hydrogen, and the process is generally known in the art as "cracking" or "reforming". A number of hydrogen-containing fluids can be used in this process by Krutzsch et al., which includes water and a hydrocarbon (HC) fuel. In the art, a HC fuel that is also used to operate the engine is preferred because it simplifies an exhaust purifying system as only one fuel tank is needed. This fact is confirmed by Akama et al. who recognize that if a separate reducing tank is utilized, the weight of a vehicle is increased and the size of the vehicle may have to be enlarged to accommodate the reducing tank (see paragraph 004). As such, Akama et al. teach that an engine fuel tank (7) that is provided to supply a fuel to the engine, is also used to feed a HC fuel to a reforming catalyst (10a), wherein the HC fuel is

Art Unit: 3748

chemically reformed or cracked to produce a hydrogen-containing gas for use to reduce NO_x emissions at a reducing catalyst (6) (see paragraph 0030).

It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Akama et al. in Krutzsch et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to improve a fuel economy of the vehicle by reducing a weight of the vehicle. As such, the cited combination of Krutzsch et al. and Akama et al. clearly disclose or teach the step of subjecting a portion of the first auxiliary agent to a chemical conversion into a second auxiliary agent.

Regarding step b), the text on lines 56-60 of column 2 and lines 11-19 of column 4 in Krutzsch et al. reads, respectively, as follows:

“Any arrangement for generating or storing hydrogen can be used as the H₂ generator (6). Particularly for a use in motor vehicles, the electrolysis of water, the generating of cracked gas or the reforming of methanol can be used for this purpose.” (emphasis added by examiner)

“The metering of the reducing agents takes place such that, in a first operating range of the internal-combustion engine (1), only hydrogen is added to the exhaust gas; in a second operating range, hydrogen as well as hydrocarbons are added to the exhaust gas; and in a third operating range only hydrocarbons are added to the exhaust gas. The operating ranges are preferably characterized by different catalyst temperatures.”

Based on the above disclosure, Krutzsch et al. teach that storing hydrogen by the hydrogen generator (6) is a function that may be optional in their system. The examiner hereby argues that this function is a must and is at least obvious in Krutzsch et al. because they supply a different reducing agent or a mixture of reducing agents to the catalyst at a specific operating

Art Unit: 3748

range or condition of the engine. If the hydrogen generator (6) in Krutzsch et al. has no function of storing hydrogen as argued by the Appellant, then Krutzsch et al. would not be able to supply hydrogen to the catalyst when their engine condition suddenly drops back to the first operating range. This is because it takes time to supply a hydrogen-containing fluid to the hydrogen generator (6) and to crack the fluid into a hydrogen gas. This fact is further confirmed by Akama et al. who utilize a storage tank (11) to store a hydrogen-containing gas so that the hydrogen-containing gas is always available for injection into an exhaust stream at a variation of engine operating conditions or changes in air-fuel ratio of exhaust gas flowing into a catalyst (see lines 4-11 of the second column on page 5 of Akama et al.)

As such, the cited combination of Krutzsch et al. and Akama et al. clearly disclose or teach the step of storing the second auxiliary agent in an intermediate reservoir.

ISSUE 2: With regard to the 35 U.S.C. 103 rejection of independent claims 11 and 30, it is improper to combine Akama et al. with Krutzsch et al.

In response to applicant's argument that it is improper to combine Akama et al. with Krutzsch et al. because Akama et al. do not teach supplying two reducing agents to an exhaust gas stream (page 12 of Appeal Brief), the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). In this case, even though Akama et al. fail to supply a HC fuel to the exhaust gas stream, the examiner

only utilize Akama et al. to teach that it is conventional in the art to fluidly incorporate a HC fuel tank to a reforming catalyst to crack or reform a HC fuel into a hydrogen gas. This teaching is applicable to Krutzsch et al. who state that their hydrogen generator is a device that generates a cracked gas.

In response to appellant's argument that it is improper to combine Akama et al. with Krutzsch et al. because Akama et al. present a special case in which an operating temperature of the exhaust gas never reaches above 250°C so that the engines in the references operate under different conditions (page 13 of Appeal Brief), the examiner again respectfully disagrees.

There is no evidence in Akama et al. that their exhaust gas never reaches a temperature above 250°C as argued by the Appellant. Akama et al. only teach the reforming or cracking a HC fuel into a hydrogen-containing gas for use in the efficient reduction of NO_x at a catalyst (6) at a low exhaust gas temperature of 200°C or lower (emphasis added) (see paragraph 0007). This is consistent with Krutzsch et al. who supply a hydrogen gas to their catalyst when its temperature is below 200°C (see Figure 4 and lines 12-20 of column 4). As such, it is deemed appropriate for the examiner to combine Akama et al. with Krutzsch et al. because the engines in both references operate under the same condition.

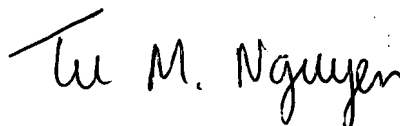
(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

Art Unit: 3748

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,



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tmn

July 19, 2007

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